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DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

PLANNING OF ALASKAN PORTS

BY

PAUL WHITHAM

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

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LETTER OF TRANSMITTAL.

Seattle, Wash., *August 17, 1915.*

Sir: Pursuant to a conversation had with you while I was in Washington, June 18, I have prepared a report entitled "Planning of Alaskan Ports," which is presented herewith.

I have prepared excerpts from some articles on port-terminal problems recently published in technical journals and incorporated them as an appendix. While the matter contained in this appendix does not bear directly on the Alaska problem, yet there are some points that might be of general interest in connection with the study of the Alaska situation.

I realize that the accomplishment of the suggestions made is not likely to be the result of popular demand, for the reason that people generally, and quite naturally, have little conception of the value of such things, or at least they do not appreciate them until they are visualized by actual accomplishment. The planning of Alaskan ports must be brought about, if at all, through the initiative of Government officials and the men in Congress who are in a position to appreciate the advantages to be gained by the development of the ports in an intelligent manner.

If this information shall prove of some value to you I shall feel fully repaid.

Respectfully,

Paul Whitham,
Consulting Civil Engineer.

Hon. Franklin K. Lane,
Secretary of the Interior.

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PLANNING OF ALASKAN PORTS.

By Paul Whitham.

INTRODUCTION.

The time is at hand when the Government should formulate a policy relating to the development of the ports and harbors of Alaska and outline the procedure by which the foreshores of the same may be acquired or used.

During the pioneer days, the beginning of things, the need of taking forethought for the future and planning broadly is not generally apparent, and quite naturally so. In the "States" experience is demonstrating, however, the ultimate inconvenience, waste, and cost resulting from just letting things grow. To waive the matter aside, on the assumption that the ports of Alaska will never become of such size and importance as to justify a serious effort to control and "shape up" their development along the most efficient lines is not giving due consideration to the ultimate possibilities of the Territory. If the faith in a magnificent destiny for Alaska, held by those who know the country best, is well founded, a number of important ports are bound to develop. And that very development will be materially aided by taking time by the forelock and planning wisely and broadly, therefore, in the near future.

HARBOR LINES.

The general control of navigable waters vests in the Congress of the United States the actual execution of such matters having been delegated by Congress to the Secretary of War. Section 11 of the act of March 3, 1899, provides as follows:

> That where it is made manifest to the Secretary of War that the establishment of harbor lines is essential to the preservation and protection of harbors he may, and is hereby authorized to cause such lines to be established, beyond which no piers, wharves, bulkheads, or other works shall be extended or deposits made, except under such regulations as may be prescribed from time to time by him.

The establishment of harbor lines does not grant the privilege of ownership, but rather is in the nature of the issuance of a general permit to the effect that within the limits set by the lines there is no objection made by the United States, as a trustee for the people, to the use of these submerged lands for the erection of structures serving and aiding commerce and navigation.

Except for its own purposes the Federal Government does not undertake to provide shipping facilities, but confines its actions to matters relative to the general needs of commerce and navigation, such as the improvement and maintenance of waterways which are free and open to the use of all. On the State or other local authority rests the burden of providing the necessary shipping facilities at each particular port. At San Francisco, for instance, the State itself has improved the water front. In the State of Washington, on the other hand, the title of the shore lands for the most part has been passed to individuals, placing on them the burden of improvement. Only recently at Seattle a port commission was created, with authority to provide public shipping facilities. Before any structures could be erected the public was forced to buy from private ownership, paying therefor thousands of dollars per acre for property which comparatively a few years ago the State had parted with for merely a nominal sum.

Without going into an argumentative discussion, in regard to private or public ownership of the water front, this much is clear: The best results are not obtainable if the development of a port is left to individual effort undirected by some general authority.

AUTHORITATIVE CONTROL.

Usually when a specific improvement is being planned by a private individual or corporation the limits of the particular property and the requirements of the transportation agency or industry proposing to use it only are taken into consideration, with little or no thought for the general arrangement and development of the port. This is very natural; the inevitable result, however, is a hodgepodge development of the port, finally working to the detriment of all concerned. To get away from this the local State or Territorial authorities should cooperate with the Secretary of War. In connection with or preliminary to the establishment of harbor lines, the possibilities of the harbor should be studied with a view to outlining the best general arrangement of the port, making it possible to issue permits intelligently, and thus control the position of the wharves or piers and width and direction of slips.

APPLICATION TO THE ALASKA PROBLEM.

The establishment of the harbor lines at Alaskan ports presumably would come under the jurisdiction of the War Department, as in the "States." The matter of planning for the development back of the lines rests in the Department of the Interior, at least until the authority is delegated to a commission or some other form of local government for Alaska. In the meantime, transportation requirements are rapidly outgrowing the capacities of the existing docks and wharves of most of the ports, which will force in the near future an extensive reconstruction program all along the line. Before that takes place, if possible, port plans for at least the principal harbors should be prepared as a basis for issuing permits for new work. At present permits are of necessity issued blindly, there being no basis on which to take intelligent action.

HYPOTHETICAL CASE.

For the purpose of illustration and the drawing of comparisons between the haphazard and the prearranged methods of port development, we will assume a hypothetical case: the port of X, Alaska. (See attached Pl. I.) On this map are shown three drawings of the port of X, designated *A*, *B*, and *C*. This imaginary port in its outline is rather typical of inlets along the coast of Alaska.

THE BEGINNING.

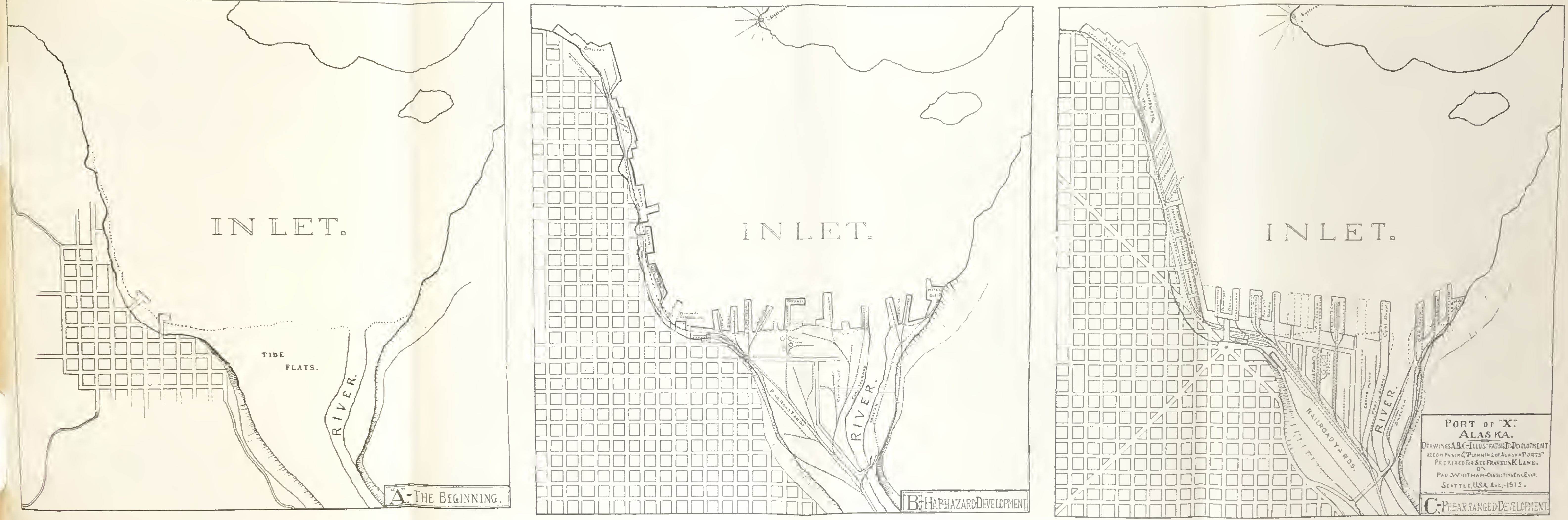
Pl. I, *A*, illustrates the first stage in the development of the port, in which a small village has been established, the houses of which cluster about one or two small wharves.

HAPHAZARD DEVELOPMENT.

Pl. I, *B*, illustrates the port of X after it has grown to be a place of considerable importance and has become the terminal of a railroad. It has grown up in haphazard fashion, there never having been prepared a general plan or guide to serve as a basis upon which to control and direct the development of its dockage and railway facilities along lines of economy and efficiency. The result, as compared with that shown on *C*, at first may seem somewhat far-fetched; as a matter of fact, however, there are numerous examples in this country that are, if anything, worse than the condition pictured on the drawing, and some of the Alaskan ports have obtained a substantial start in the same direction.

PREARRANGED DEVELOPMENT.

On Pl. I, *C*, the port of X is assumed to have reached approximately the same stage of development as that shown on *B*, but instead of having been allowed to grow up in a haphazard fashion, shortly after the first stage (Pl. I, *A*), had been reached, a systematic plan for the



"A"-The Beginning.

"B"-Haphazard Development.

"C"-Prearranged Development.

PORT OF "X."
ALASKA.
Drawings A.B.C.-Illustrating Its Development
Accompaning "Planning of Alaska Ports"
Prepared for Sec. Franklin K. Lane.
By
Paul Whitham-Consulting Civil Engr.
Seattle, U.S.A.-Aug.-1915.

development of the port and the railway terminals was prepared, and thereafter, as near as was practicable, improvements that were made from time to time were required to conform to the general scheme. The advantages of the systematic arrangement are quite clearly portrayed on the drawing. The real advantages of convenience, economy, and efficiency are hardly subject to presentation by means of a diagram and have to be seen in fact to be fully appreciated.

SUGGESTED PROCEDURE.

Enough has been said to fully emphasize the importance of port planning in Alaska. As to how provision should be made for such planning is not for me to suggest, except that I might point out that for the harbors which it would seem advisable to plan at this time an appropriation of not less than $50,000 should be provided, unless much of the field and survey work on which to base the planning could be done through one of the regular departments of the Government, the cost not appearing in a special appropriation; in that event, probably $25,000 would cover it.

As to what should be accomplished, I would suggest as follows:

(1) Have prepared general plans of all the harbors that are of such importance or prospective utility as to justify the work.

(2) Ask for the cooperation of the War Department in the establishment of all harbor lines where such action appears to be justified.

(3) Determine as to whether or not the policy should be for the Federal Government or the Territory to retain title to all the foreshore, granting leases only; or as to whether or not, under certain conditions, title should be allowed to pass to private ownership in certain sections of the water front; it being assumed that in any case a portion of the water front at each port would be selected and reserved for public purposes or for use by transportation companies and others on a leasing basis only.

(4) Require the securing of permits for the use and occupation of the water front and the erection of structures, or the reclaiming of the same by filling; in connection with the issuance of such permits improvements to be required to conform fundamentally to the general plan previously prepared.

CONCLUSION.

It is a well-known fact that the cost of the long haul, whether it be by water or land, during the past decade has been reduced phenomenally, while, on the other hand, the cost of handling and transshipping at the terminals, for the most part, has remained stationary or in some cases increased; and this condition is in no small measure due to the fact that the port terminals have been permitted to grow with little forethought or planning. In Alaska the opportunity to benefit the present and future generations by making possible reductions in terminal cost is at hand. Considering the relatively small expense and effort necessary to bring this about, it certainly would inure greatly to the credit of Congress and the administrative authorities should they demonstrate their foresight by grasping this opportunity.

APPENDIX.[1]

PORT-TERMINAL PROBLEMS.

The literature which treats of problems having to do with docks or wharves and railway terminals is confined frequently to one or the other phase separately. As a matter of fact, any broad consideration of port-improvement problems should cover both the dock and railway sides of the work. One dovetails into the other to such an extent that they must be thoroughly coordinated and harmonized if the best results are to be obtained.

The expression "marine terminal" may, therefore, be defined as embracing the docks or wharves, railway tracks and yards, sheds, warehouses, and the miscellaneous appurtenances and equipment all of which go to make up a complete plant for the purpose of transferring commodities between water and land carriers.

The subject is of such a comprehensive nature that only the general problems will be considered here.

Each port in many ways is in a class by itself, but broadly there are two types, as follows:

(A) *Transshipping ports.*—That is, a terminal where heavy and bulk commodities are transshipped, but where little general commercial and industrial business is carried on.

(B) *Commercial and industrial ports.*—That is, a terminal which is a general distributing and industrial center, as well as one in which a purely transshipping business is conducted.

As a matter of fact, there are ports which range all the way between these two types, but the really great ports—that is, the large lake and seacoast cities—fall under type "B."

The problems connected with the development of a purely transshipping port are quite simple as compared with those encountered in the planning of a general commercial and industrial port. The marine terminals in the former are usually provided by the one or more railroads using the port. Such terminal units are rarely coordinated, nor is it so important that they should be. On the other hand, a port of type "B" must be developed in accordance with a comprehensive plan in which the various districts are thoroughly coordinated if the greatest efficiency is to be obtained. It is primarily the problems having to do with the commercial and industrial ports that will be discussed in this paper.

The marginal or belt railway may be termed the backbone of a port system. Carrying out the analogy, the deep-sea terminals would be the arms reaching out for the commerce of the world; the legs would be the local shipping and industrial facilities bearing the burden of community distribution. As a man without a backbone can make but little use of his arms and legs, so a port without a belt railway system coordinating all its various units must labor under a serious handicap.

MARGINAL OR BELT RAILWAY.

Wherever the physical conditions permit, the water front should be skirted by a continuous marginal street and beltline railway, and where not continuous, the various sections should be joined in the most practical manner. Furthermore, the belt railway should connect with the trackage serving the warehouse and industrial districts, whether they are situated adjoining the water front or some distance back therefrom. The belt railway, its connections and lateral extensions, should be accessible to all the railways reaching the city, thus insuring the welding of all the various transportation agencies, including docks, warehouses, industries, and railways, into one great port-terminal system.

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[1] Excerpts from papers on marine terminal problems by Paul Whitham, recently published in technical journals.

There has been some difference of opinion between public authorities and railway officials as to how this should be brought about, or as to whether or not such coordination of the railway terminals was desirable. I believe all engineers who are students of the problem will agree, however, that it is advantageous. As to whether it should be brought about by public authority or by arrangement among the railroads is immaterial, so long as the results are accomplished. The fact remains, however, that only where the public authorities have taken over the situation are the railway facilities along the water front properly coordinated, as at San Francisco, New Orleans, and Montreal. Seattle is an exception to the rule, as physically it has a splendid belt-line system owned by the railroads, the principal fault being that the operation is somewhat disjointed.

The main difficulty in the way of proper coordination of the trackage facilities by the railway companies themselves lies in the fact that the older and better established roads dislike to give up such advantages as they may have gained as a result of their pioneering. From the railway companies' standpoint, their view is a perfectly natural and sound one, and as a matter of common equity they should be compensated in some manner for what they would have to sacrifice in the readjustment necessary to the desired results.

From the standpoint of the port or municipality, however, a unified system is economically correct, and in the long run I believe would prove so even to the roads apparently forced to sacrifice some of their advantages in the first instance. The avoiding of unnecessary duplication of trackage, for instance, would result in a distinct saving. The blame for failure to bring about the proper coordination should not be placed altogether on the railway officials, as the radical and hostile stand frequently taken by municipal authorities often makes cooperation by the railroads impossible. As a matter of fact, the common interest is such that the problems should be approached in a friendly spirit of mutual helpfulness. Practical cooperation in such a spirit would undoubtedly result in most cases in the solution of the problems without resorting to public ownership and operation of terminal railways. In case of failure to get together, however, the indications are that the inevitable result will be public-owned belt lines in the more progressive ports.

The marginal railway being established, then upon it, the backbone of the port system, can be built up the various terminal units.

A study of the situation will develop the fact that certain portions of the water front are particularly adapted to or so situated that they should be used as follows: (*a*) City business (local or coastwise shipping); (*b*) deep-sea terminals; (*c*) industrial water front.

(*a*) *City business.*—The local and coastwise shipping, which is usually closely connected with the retail and local jobbing business of the port, should be concentrated, as nearly as practicable, in front of the business center of the city. Usually it is not feasible, nor is it desirable, to have extensive railway facilities in connection with docks designed for such purposes. A marginal street along the water front is of great importance, however, and in connection therewith it is advantageous that sufficient belt-line trackage be provided to insure rail service to the docks and warehouses wherever the need arises. Unless grade separation is feasible, it usually is necessary to restrict the switching in such a district to certain specified hours.

An important phase of local traffic, which may be termed water cartage, usually develops in ports having extensive water frontage and outlying waterways. In the effort to properly equip the port to take care of the larger shipping, the needs of these local carriers frequently are overlooked, resulting in unnecessary congestion and cost of local distribution. Not only should specially designed facilities be prepared to accommodate the water-cartage service at the city terminals, in front of the business district, but subdistributing and collecting facilities for such carriers should be located at various advantageous points about the port, particularly in the industrial district, and to a certain extent in connection with the deep-sea terminals.

(*b*) *Deep-sea terminals.*—The shipping facilities designed to accommodate the large freight carriers need not be located adjacent to the business center of the city. In fact, it is better that they be located elsewhere, for the reason that such terminals should be conveniently situated with reference to ample railway yards and trackage facilities. It is also desirable in ports of the first magnitude to have back of the dock frontage extensive areas suitable for warehouse and intensified industrial purposes.

In the larger ports several terminal units are the natural development. These should be compact, yet comprehensive, so that in connection with a series of docks or piers there may be ample railway trackage and warehouses, grain elevators, and all other facilities necessary to make a complete and well-rounded shipping unit. Thus it will be possible without shifting berth, for a ship to receive or discharge passengers, general merchandise, and grain and other bulk commodities and goods requiring ordinary and cold storage warehousing.

(*c*) *Industrial water front.*—It may sound rather odd to speak of an "industrial terminal," but as a matter of fact the industrial districts should be considered in the general port-terminal scheme. It is just as important that the industrial areas be intelligently platted with a view to transportation efficiency as it is to properly plan the dock and warehouse layouts. What may be termed intensified industries frequently can be located adjacent to deep-sea terminals with particular advantage. The industries requiring water frontage or large ground areas usually seek cheaper locations, more remote from the commercial center of the city. The shoaler waters of the port are adapted to such purposes providing sufficient depth of water is obtained to accommodate small vessels, harbor boats, and lighters. Generally speaking, the major portion of such water frontage should be left to development by private industries requiring direct access to the water front. A sufficient number of public wharves and landings should be reserved, however, in order to insure to those industries located back of the water front the privilege of water transportation with the minimum drayage haul.

Usually the needs of vehicle traffic are anticipated in connection with the platting of industrial property. Later, spur tracks are worked in any old way, the final result being a hodgepodge mess with much wasted property. As a matter of fact, it is, if anything, more important that the railway service scheme be systematically laid out than that the vehicle thoroughfares be platted beforehand. In the beginning each industrial district should be so studied and planned that every lot and parcel of ground may be served to the best advantage with railway trackage, such trackage to be connected with the general port belt railway system.

EXAMPLES.

So much for the general principles governing port-terminal development. Now for examples or illustrations of what has been accomplished in actual practice. On account of the limited space, four ports only will be described, to wit: (1) New York, (2) Buffalo, (3) Seattle, (4) San Francisco.

It possibly would be of interest to include several foreign ports in the list, but the conditions surrounding their development are quite different, and besides, the available space will not permit.

PORT OF NEW YORK.

New York, measured by the volume of business and many other big features, is the greatest port in the world, yet to the trained eye there is something lacking. What this is becomes apparent from a study of the general outline plan of the port. The backbone of the terminal scheme, that is the marginal streets and railways connecting the various units, have not been fully developed. Those in charge of port affairs, however, are aware of this defect and are putting forth efforts to connect the various disconnected sections of the backbone. They are handicapped by the fact that the harbor is cut into longitudinally by the interstate line drawn through the upper bay and along the Hudson River. Geographically and commercially the port is one, but politically it is separated into halves. There is promise, however, that this difficulty will be overcome, in a measure, as the result of the formation of a New Jersey harbor board and the promised close cooperation between it and the department of docks and ferries having jurisdiction over the New York side.

City business.—The city business, that is, the passenger, package freight, and local shipping is logically centered about Manhattan Island. The passenger and express business is really national in its scope, however, on account of New York being the American terminus of the great trans-Atlantic ferry service. A large proportion of New York's water front is utilized for purely local traffic, that is, what might be called a water-cartage business carried on in car ferries, lighters, and harbor boats of all descriptions. The East River, Harlem, and the shoal portions of the Jersey shore are practically all given over to local and industrial business. Even on the North River side of Manhattan Island the terminal frontage required for the local transfer of freights is so extensive that it is difficult to make room for the facilities necessary to keep pace with the growing trans-Atlantic passenger and express business.

Deep-sea cargo terminals.—Logically, a preponderance of the terminal facilities to take care of the transshipping and heavy cargo business should be located on the Jersey shore, where the railroads are situated. To a certain extent this has been done, but apparently full advantage of the situation has not been taken. Tentative plans, however, have been prepared for the Jersey harbor board, proposing to reclaim the shallow areas on the upper bay by dredging and filling, thus creating terminals on a larger scale than heretofore attempted.

On the Brooklyn shore of the upper bay the most extensive transshipping and storage terminal development has taken place, in spite of the fact that rail service has been dependent on car ferries. The extensions of the Pennsylvania and the New York, New Haven & Hartford trackage to Long Island, together with contemplated extensions and belt line tracks, is greatly improving the situation.

To further develop this district it is proposed to coordinate the terminal systems of the dock department, New York Dock Co., and the Bush people, between the Bayridge Terminal and the Brooklyn Bridge, by the construction of a marginal street and railway along that section of the water front. The enormous cost of bringing this about at this late day should be an object lesson to newer communities having the opportunity to plan broadly and correctly before the building up of the property makes it difficult if not impracticable of accomplishment.

Industrial water front.—Many miles of the harbor front are occupied by industrial establishments, but as a general thing there is little systematic development for such purposes. The most notable instance of scientific industrial planning is at the Bush Terminal, and to some extent on the property of the New York Dock Co.

The evident shortcomings of the hit-or-miss industrial growth has aroused the port authorities and others interested to the need of providing well laid out industrial water-front property.

The Jamaica Bay project now apparently on the way to accomplishment is the outgrowth of this awakened interest. On the Jersey side the new harbor board, as well as private concerns, have prepared tentative plans for industrial districts laid out with a view to transportation efficiency and economy.

Some of the noteworthy features in regard to the port of New York may be summarized as follows:

(1) The failure in earlier days to have prepared and followed up a comprehensive scheme of port development, resulting in much inconvenience and loss, more apparent in New York than elsewhere on account of the magnitude of its commerce.

(2) Herculean efforts are now being made to straighten things out and properly coordinate the harbor system with the prospect that the efficiency of the port will be greatly improved during the next few years.

(3) There are a number of splendid terminal units in the port which forcibly illustrate the advantage of grouping docks and warehouses in close administrative and operating units.

(4) There is a tendency, as elsewhere, to look after the big shipping, and let the local business take care of itself. This is a mistake, as evidenced by the unnecessary congestion and waste effort that has been the result in New York.

(5) New York is a special condition, consequently many of the detailed solutions of its problems can not be applied elsewhere; but as to the fundamentals of port planning, there is much worthy of emulation, as well as object lessons of what not to do.

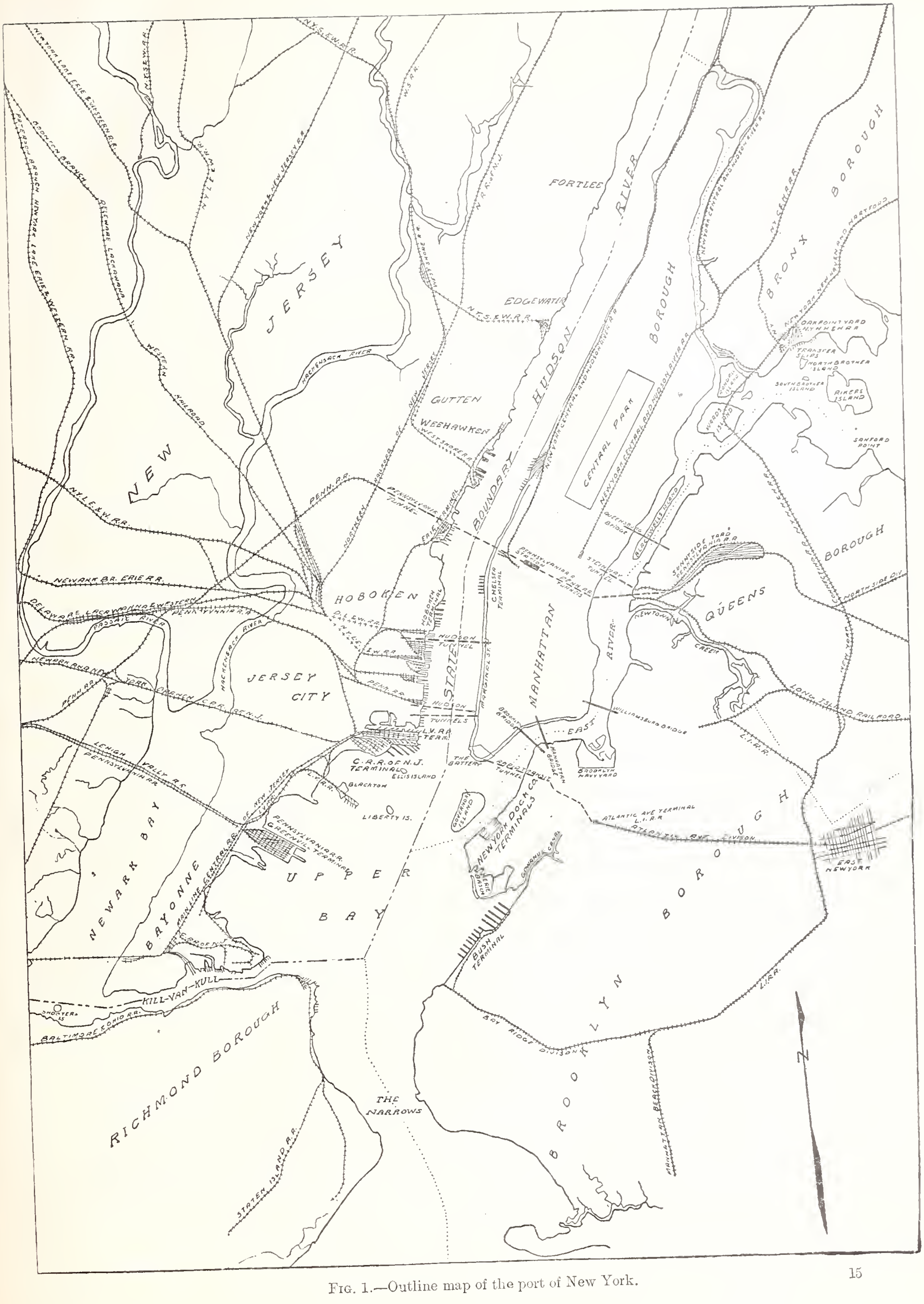

Fig. 1.—Outline map of the port of New York.

PORT OF BUFFALO.

Port-terminal engineers have been prone to overlook the Great Lakes in their search for helpful information, while, as a matter of fact, some of the greatest ports of the world are located on the Great Lakes. One reason may be that the shipping and harbor conditions on the Lakes are quite different from those encountered at the seacoast ports. There are, however, certain underlying principles essential to the economic development of terminals that will apply to both lake and coast ports. Much may be found at the leading lake ports, such as Buffalo, Cleveland, Chicago, Milwaukee, and Duluth, that will furnish good subject matter to those interested in the general problems of port and terminal development.

The writer has chosen to describe the port of Buffalo, not, perhaps, that Cleveland or Duluth or other places are not of equal interest, but for the simple reason that he is more familiar with Buffalo.

The shipping business at Buffalo is diversified to a greater extent, perhaps, than some of the other leading lake ports, on account of the fact that it is the easterly terminus of the large vessels operating on the Lakes and is the westerly terminus of the Erie Canal now being converted into a barge canal.

Like others of the lake ports the harbor at Buffalo is a combination of artificial inclosure formed by breakwaters and a river channel dredged and straightened to meet the demands of commerce.

The port terminal facilities at Buffalo, as in most of the ports of this country, "just grew," with the consequent result that the general arrangement of the facilities falls materially short of what they should have been if constructed in conformity with a predetermined comprehensive scheme.

The barge canal commission, the municipal authorities, and some of the public organizations of Buffalo are now alive to the need of better planning for the future. It has been proposed that the municipality acquire the water front on the outer harbor, a portion of which is already served by the belt line connecting with the various railway systems centering at Buffalo. This system may be readily extended along the Hamburg turnpike, thus giving to the outer harbor a backbone for its future improvement, making possible the construction of well-coordinated shipping facilities.

Most of the existing facilities are located on the river and city channels which compose what may be termed the "inner harbor." In this inner harbor are located the general freight and passenger docks and local landings, as well as facilities for handling bulk and heavy cargoes.

At the entrance to the inner harbor the barge canal commission now have arranged to construct the first unit of the new barge terminals, which will be a great improvement over the existing facilities. The city has already acquired 4,000 feet of water frontage facing the outer harbor and situated northerly from the entrance of the inner harbor.

Between Buffalo and Tonawanda the Erie Canal has been enlarged into a shipping channel and new locks built to overcome the rapids and to accommodate vessels up to 70 by 700 feet. This will make the slack-water district in the vicinity of Tonawanda about Grand Island available for shipping and particularly for industrial water-front purposes, the useful frontage of which is estimated to be between 50 and 60 miles. Apparently it is still practicable to coordinate the various existing and proposed terminal and industrial sections of Buffalo, thus developing a well-systematized port terminal.

PORT OF SEATTLE.

From a practical standpoint, the above heading is a misnomer: it really should be the Port of Puget Sound.

That portion of Puget Sound including Everett, Seattle, and Tacoma, from a transportation standpoint constitutes one port terminal district, and the policies in regard to its development should be based on that theory if the best results are to be achieved.

Seattle is the financial and population center; consequently on Elliott Bay will be situated the more intensified activities. At Everett and Tacoma there is ample water frontage and

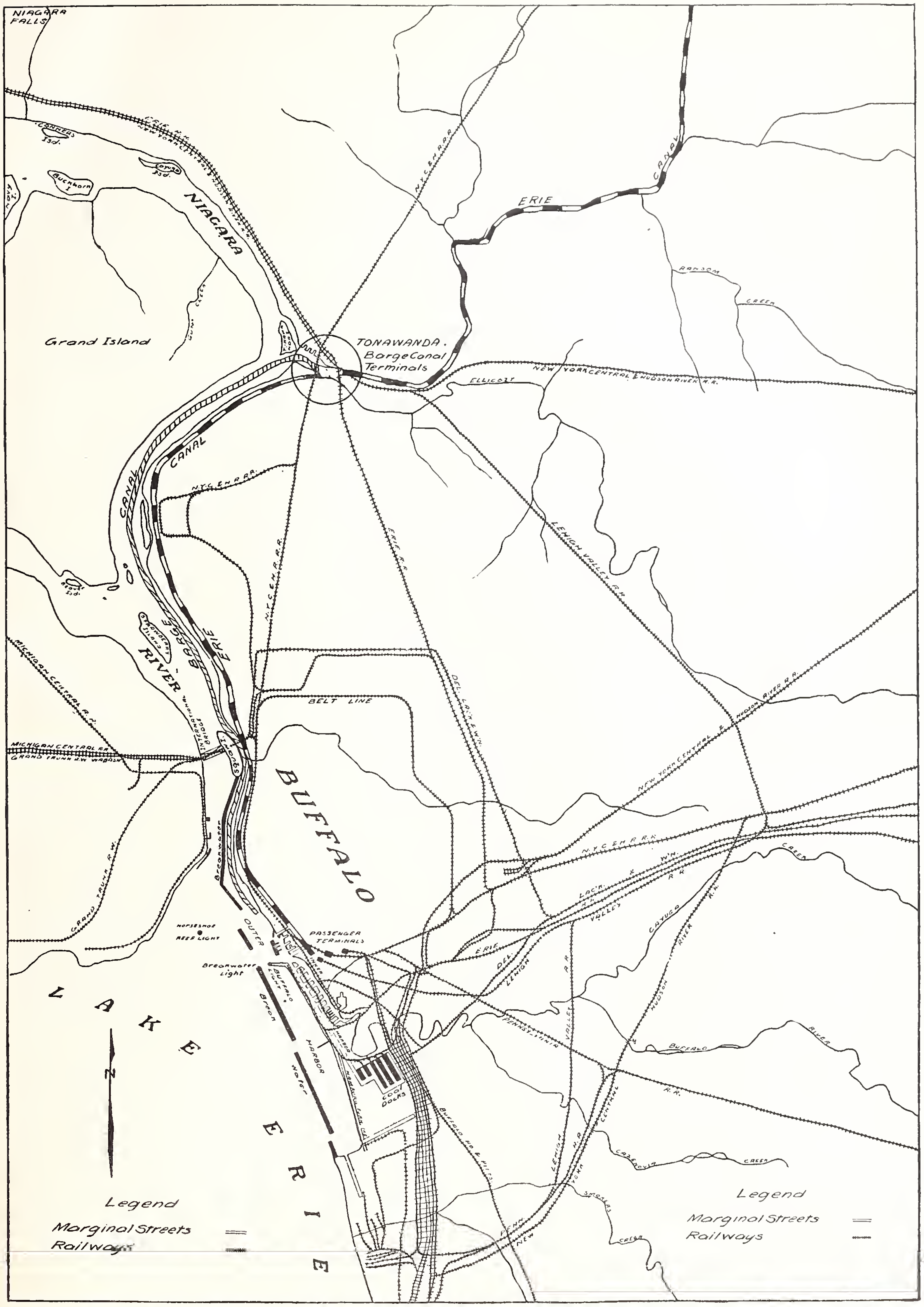

FIG. 2.—Outline map of the port of Buffalo.

extensive tide-flat areas suitable for industrial enterprises and the shipping concerns requiring large areas on which to economically transact their business. Neither of the last-named places has organized the development of its splendid possibilities. Seattle, on the other hand, some three years ago organized a port commission, which has undertaken the comprehensive development of the port.

The city is built on a hilly strip of land from 2 to 6 miles in width, situated between Puget Sound on the west and Lake Washington on the east. About half way between Salmon Bay, an inlet from Puge Sound, and Lake Washington is Lake Union, in practically the heart of the city. Nature went a long way toward connecting Salmon Bay with the two lakes. What little was left for man to complete is being done by excavating what is known as the Lake Washington Canal and the construction at the narrow entrance to Salmon Bay of a lock capable of passing the largest vessels now plying the Pacific. Upon the completion of this lock, within the year, Salmon Bay will become a nontidal basin about the size of the combined Royal Victoria and Edward Dock Basins of London. Its level will be that of Lake Union, approximately 8 feet above high tide.

The level of Lake Washington will be lowered 8 feet to the level of Lake Union. Thus will be created a nontidal practically fresh-water harbor, with approximately 100 miles of shore line.

Extending southward from Elliott Bay is the Duwamish Valley, from 1 to several miles in width. This low-level land connects with the southern end of Lake Washington, at Renton, and by the White River Valley with Tacoma. The Duwamish River is being straightened and canalized southward from Elliott Bay, some 5 miles, thus creating an industrial harbor, the swampy lands on both sides of which are being reclaimed with the dredged material at the south end of Elliott Bay. Already over a thousand acres of tide flats have been reclaimed and to a large degree utilized.

The major portion of the existing shipping facilities are on the eastern shore of Elliott Bay.

Railway situation.—The principal railway entrances to the city are from the north and south, forming a big Y, the stem of which lies in the Duwamish Valley, and the respective branches following the shore of Puget Sound and the west side of Lake Washington northward from Union Bay. The projected junction is at the northerly end of Lake Union, which will become an actuality when the tracks on the southern tide flats are connected with the Lake Union belt line by means of a tunnel under the city. The real junction at present is in the low-lying draw, situated between Salmon Bay and Smith Cove, at the northerly end of Elliott Bay, known as the Interbay district. Naturally the railway yards and terminals have been developed at the Interbay or North Terminal district. At some distance from the city the railroads have located their larger general classification yards, designed to serve the entire Puget Sound Terminal district.

Marginal streets have been located about the shores of Elliott Bay, with extensions into the North and South Terminal districts. Proceedings are now under way for the condemnation of two marginal streets, one on each side of the Duwamish waterway. These marginal streets will be occupied by extensions of common-use railway tracks. It is proposed that the marginal streets in the Duwamish Valley be extended eventually to a connection with the marginal streets recently platted along the water front, at the south end of Lake Washington. About the lake are several districts suitable for industrial water-front purposes, particularly at the north and south ends, where marginal streets have been platted in contemplation of belt line railway service.

Around Lake Union and along both sides of Lake Washington Canal marginal streets are in existence or are being acquired. A number of connections and extensions are yet to be made in order to complete the system, but as the matter stands, the backbone of Seattle's port terminal system is probably better developed than that of any other city in this country. No little credit for this is due to R. H. Thomson, former city engineer, who had the foresight to see and the ability to force the laying out of the foundation of the system before its need was generally recognized. The work of Mr. Thomson was emphasized and enlarged upon by

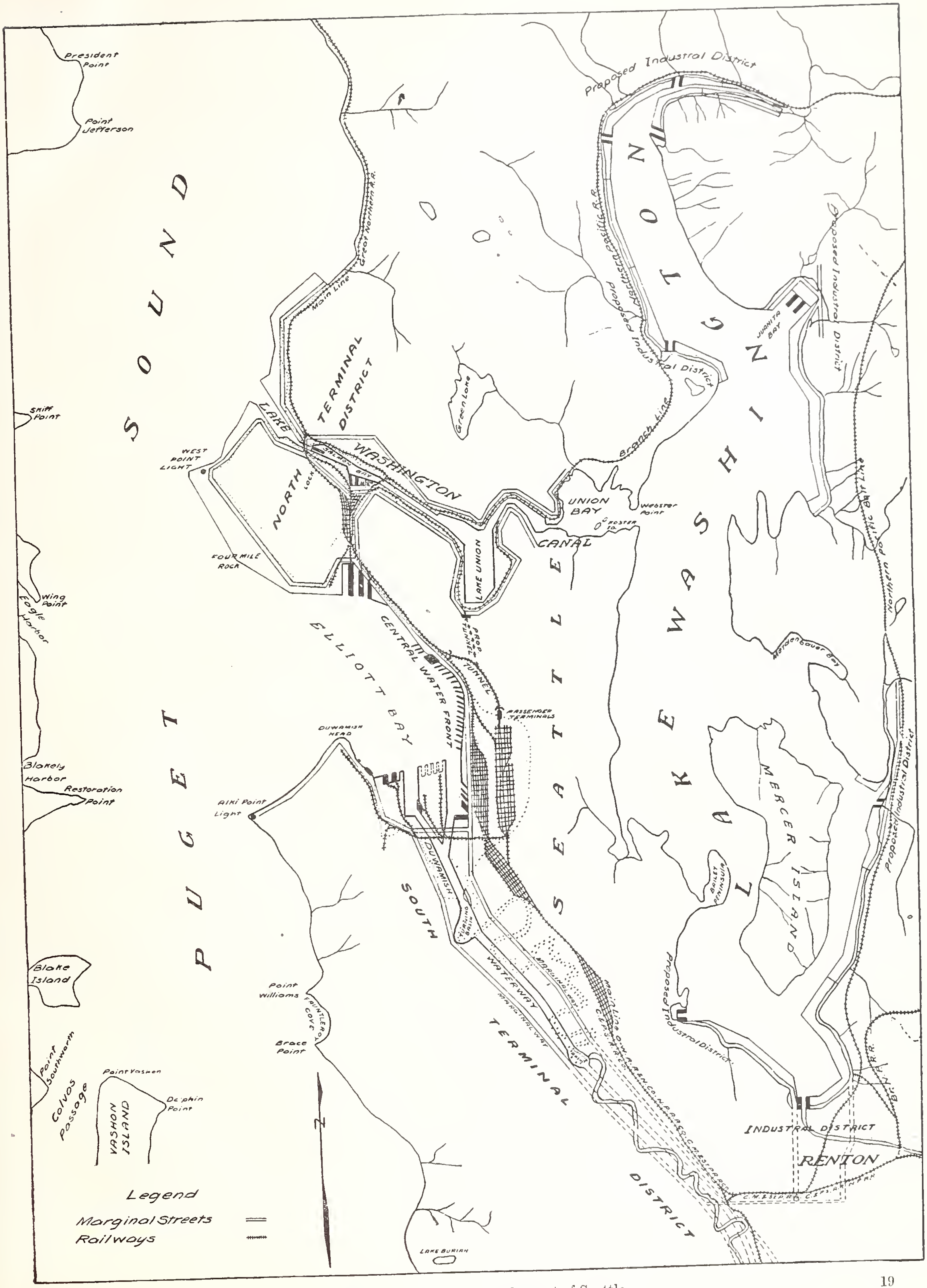

Fig. 3.—Outline map of the port of Seattle.

Virgil G. Bogue, of New York, who, in the preparation of the plan of Seattle, devoted particular attention to the railway and water-front development.

Deep-sea terminals.—Knowing the railway and topographic situation, it is not difficult to see the logic for choosing the North and South Terminal districts as the sections that may be developed most advantageously by the construction of docks, warehouses, railway yards, etc., designed for the accommodation of over-seas shipping.

The North Terminal district has a frontage on both Elliott and Salmon Bays, the 2-mile draw between the bays being well adapted to railway trackage, warehouse, and industrial purposes. At the Elliott Bay end the plan provides for a series of great piers varying from 1,500 to 2,500 feet in length.

The South Terminal district has a splendid frontage on Elliott Bay. The principal features are the east and west waterways, each 1,000 feet wide and approximately a mile in length. Between the two waterways is about 400 acres of reclaimed land, known as Harbor Isalnd. At the northerly end of this it is possible to construct five double-width piers, 1,500 feet or more in length.

The present port improvements in this district are on the east side of the waterway adjacent to the built-up section of the tide flats.

Local shipping facilities.—Joining these two terminal districts is a 3-mile strip of land along the east shore of Elliott Bay wide enough to allow for a marginal street and one line of warehouses between it and the low bluff. This is known as the central water front district, and being in front of the business center is largely used for and is particularly adapted to the local and coastwise shipping. Here are located a number of privately constructed passenger and package freight piers that have the finest passenger accommodations of any piers on the coast. The port commission has erected its initial unit in this district at the foot of Bell Street.

The completion of the Lake Washington Canal will make practically all parts of the city available by water transportation. This, coupled with the fact that Puget Sound itself, with two or more thousand miles of shore line, is one huge harbor, indicates that an enormous water carriage business is bound to develop, as it has at New York City.

Lake Union, situated in the heart of the city, will become the crowded terminal for much of this business. Public landing sites have already been acquired in anticipation of the development of Lake Union. Those who have had to do with the planning of the port of Seattle on such broad lines undoubtedly have been inspired by the greatness of the natural harbor.

PORT OF SAN FRANCISCO.

Rivaling Puget Sound as a great natural harbor is San Francisco Bay. The expression "port of San Francisco," if interpreted locally, is also a misnomer, for the reason that the entire bay is, and from a practical administration and operating standpoint should be, treated as one big port terminal.

San Francisco, like New York, is laboring under the handicap of having its port politically divided into two parts, with a resultant lack of coordination and balance in development. Also like New York, the principal railway terminals are on the side of the harbor opposite the central business section of the community. Under the circumstances, it would appear that the transshipping docks, where heavy direct ship-rail transfers take place, would naturally be located on the east side of the bay, in close proximity to the railroads and their yard facilities. The principal dock improvements have been made on the west side of the bay, where the water front is owned by the State and directed by the State board of harbor commissioners. The next most important movements have been made on the east side of the bay, and in the vicinity of Oakland estuary. The other improvements are mostly ferry terminals for the various railroads and transportation companies. At Richmond, a little north of Berkeley, some facilities have been provided in accordance with a comprehensive plan of development, prepared for the city of Richmond by Haviland & Tibbetts, engineers, of San Francisco.

Railway situation.—As previously stated, the principal railway terminals are on the east side of the bay, the Southern Pacific alone having track access to the San Francisco Peninsula.

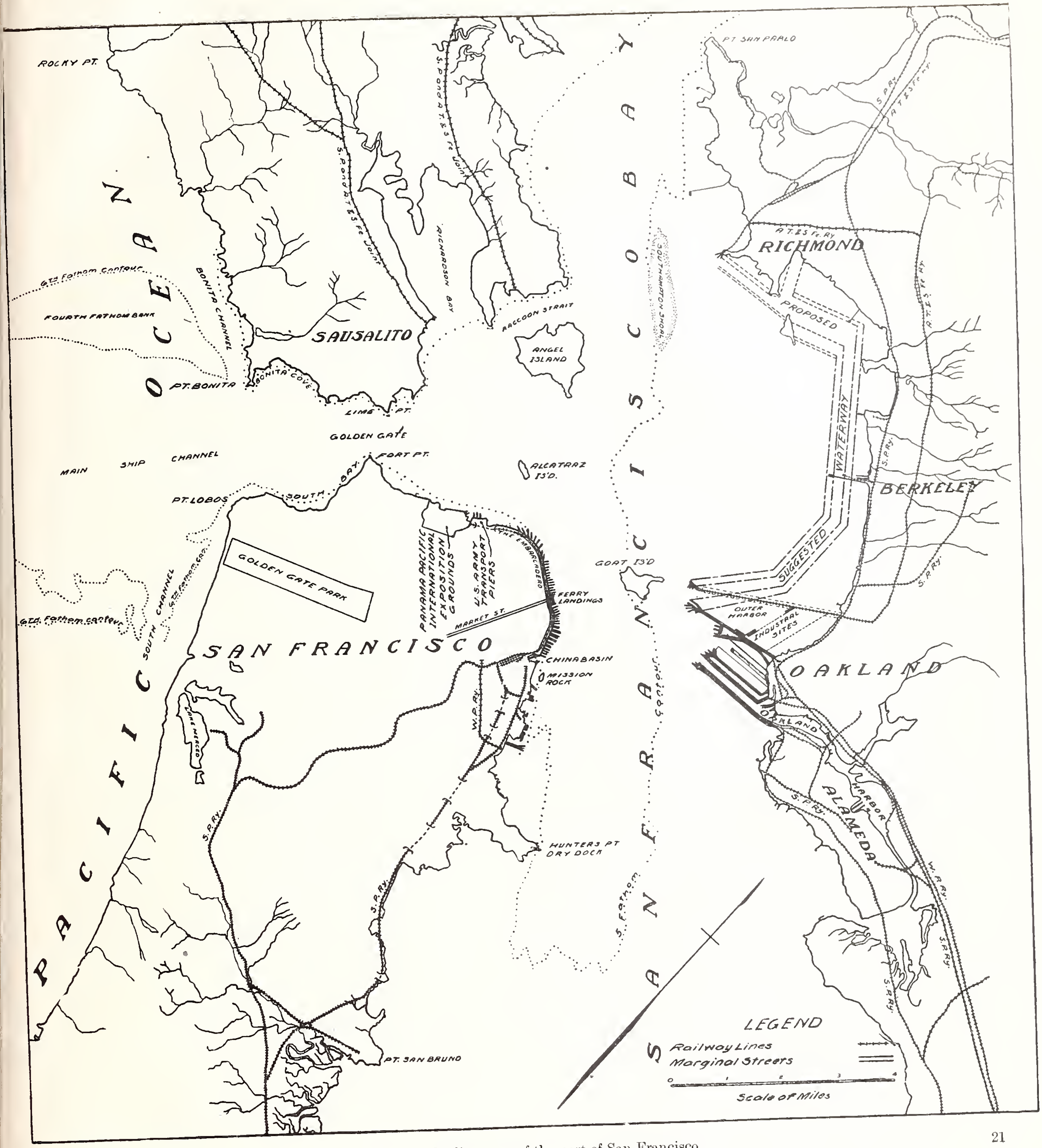

Fig. 4.—Outline map of the port of San Francisco.

The other transcontinental roads have small terminal facilities on the west side which they reach by car ferry service. The docks on the west side, between China Basin and the United States transport docks, are served by the belt line railway constructed and operated by the State harbor board. The Embarcadero, a splendid marginal street, covers the same territory.

On the east side of the bay the railway service as related to the water front, outside of the matter of ferry terminals, is in the process of being formed and shaped to meet the needs of new conditions.

A marginal street and belt line system has not yet been established, although various suggestions have been put forward with a view to bringing about a coordinated water front and industrial development embracing the east side from Richmond to Alameda.

Deep-sea shipping facilities.—Most of the docks used by the over-seas trade are on the west side, but are not clearly separated from local accommodations at San Francisco and warehouses have not been provided in connection with or supplementing the docks. The new piers are splendid structures, with large shed areas. Additional piers are being constructed under the direction of Jerome Newman, chief engineer to the harbor board. On the east side, between the San Francisco-Oakland Terminal Railways and the Southern Pacific moles, the city of Oakland has planned and done some work on an outer harbor. The dredged material is being utilized to reclaim tide-flat properties back of the proposed docks, for warehouses and industrial purposes. The proposed development at Richmond contemplates a similar improvement, combining deep-sea docks, warehouses, and industries. One suggestion contemplates the connecting of the Richmond and Oakland improvements by an inside waterway, the excavated material from which it is proposed to use in reclaiming the foreshore and the construction of a filled dike on the bay side.

Local shipping facilities are centralized on the west side, at the great ferry terminal at the foot of Market Street. This is probably the largest ferry terminal in the world. The bay and river steamer landings are mainly adjoining the ferry slips. The inner harbor on the Oakland side has developed largely as a local distributing and industrial district.

Without being fully informed in regard to the practical difficulties in the way of carrying out the work, the suggested scheme embracing the water front between Oakland and Richmond appears to offer an opportunity to develop a water front industrial district on a magnificent scale. The suggested crescent-shaped waterway corresponds in size to half the circular waterway in the Jamaica Bay district, New York, where work is under way on the largest scheme proposed of its kind in this country.

The port-terminal facilities of San Francisco Bay are impressive not only on account of the splendid improvements already provided, but also in view of the magnificent possibilities for future development.

CONCLUSION.

In conclusion, it may be well to emphasize some of the principal points. These are summarized as follows:

(1) The backbone of a port system is the belt line railway combined with the marginal street.

(2) The deep-sea terminals are the arms of the port, reaching out for the commerce of the world.

(3) The local shipping and industrial facilities are the legs of the port, carrying the burden of community shipping.

(4) A man without a backbone can make little use of his arms and legs, likewise a port without a belt railway system coordinating all its various units must labor under a serious handicap.

(5) It is necessary that the general terminal scheme be worked out before the details—that is, the docks, warehouses, and other structural units—can be properly located and designed.

The cost of living is materially affected by the cost of transportation. In this country the railway companies have broken the world's record in the matter of reducing transportation costs between terminals. The transportation charges across the ocean are frequently little

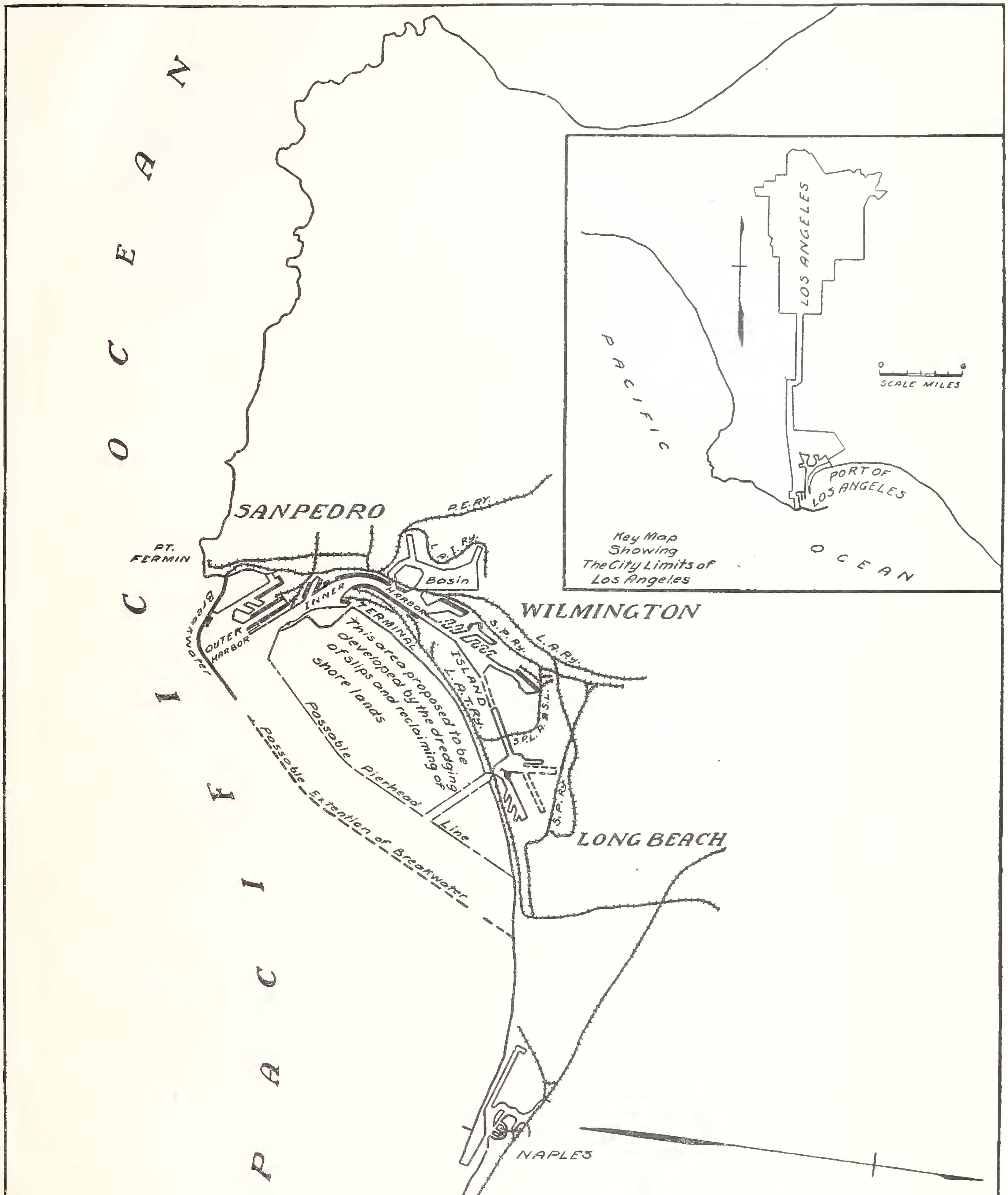

Fig. 5.—Outline map of the port of Los Angeles.

more than the cost of handling and storing at the terminals. In other words, while the transportation costs between terminals have been reduced to remarkably low rates, the handling and transshipping costs have remained stationary or increased. There are several reasons for this, among them being the failure to invent and provide mechanical handling equipment adapted to the business of discharging, storing, and loading mixed cargoes. One of the prime reasons is that terminal situations have been allowed to grow without definite forethought and planning, resulting in a hodgepodge inefficient arrangement.

The United States is now entering upon an era of development in which organization and efficiency are to play a more important part than they have in the past. The port that does not take stock of itself and plan broadly in the future will find itself laboring heavily against rival ports organized along lines that lead to terminal efficiency.

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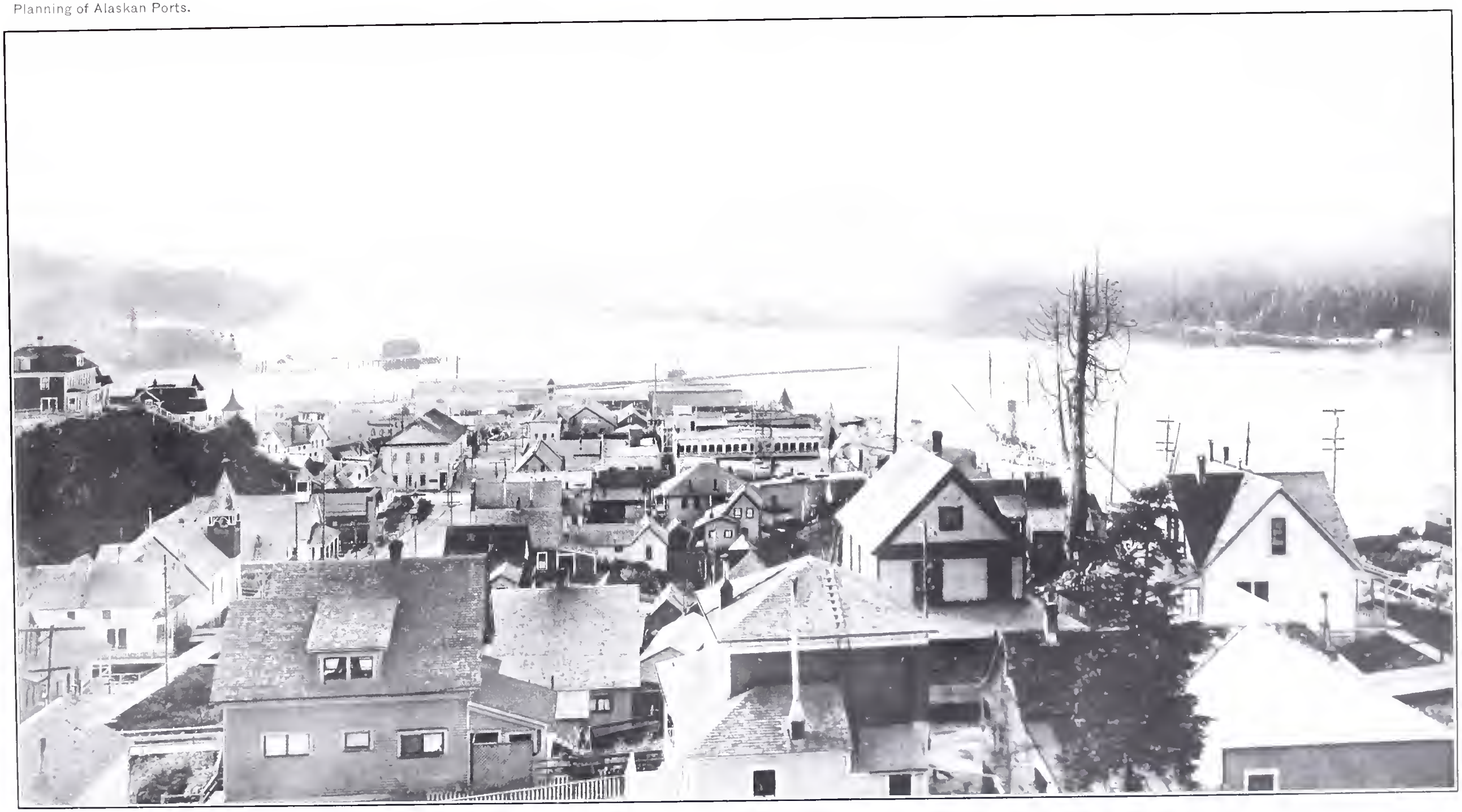
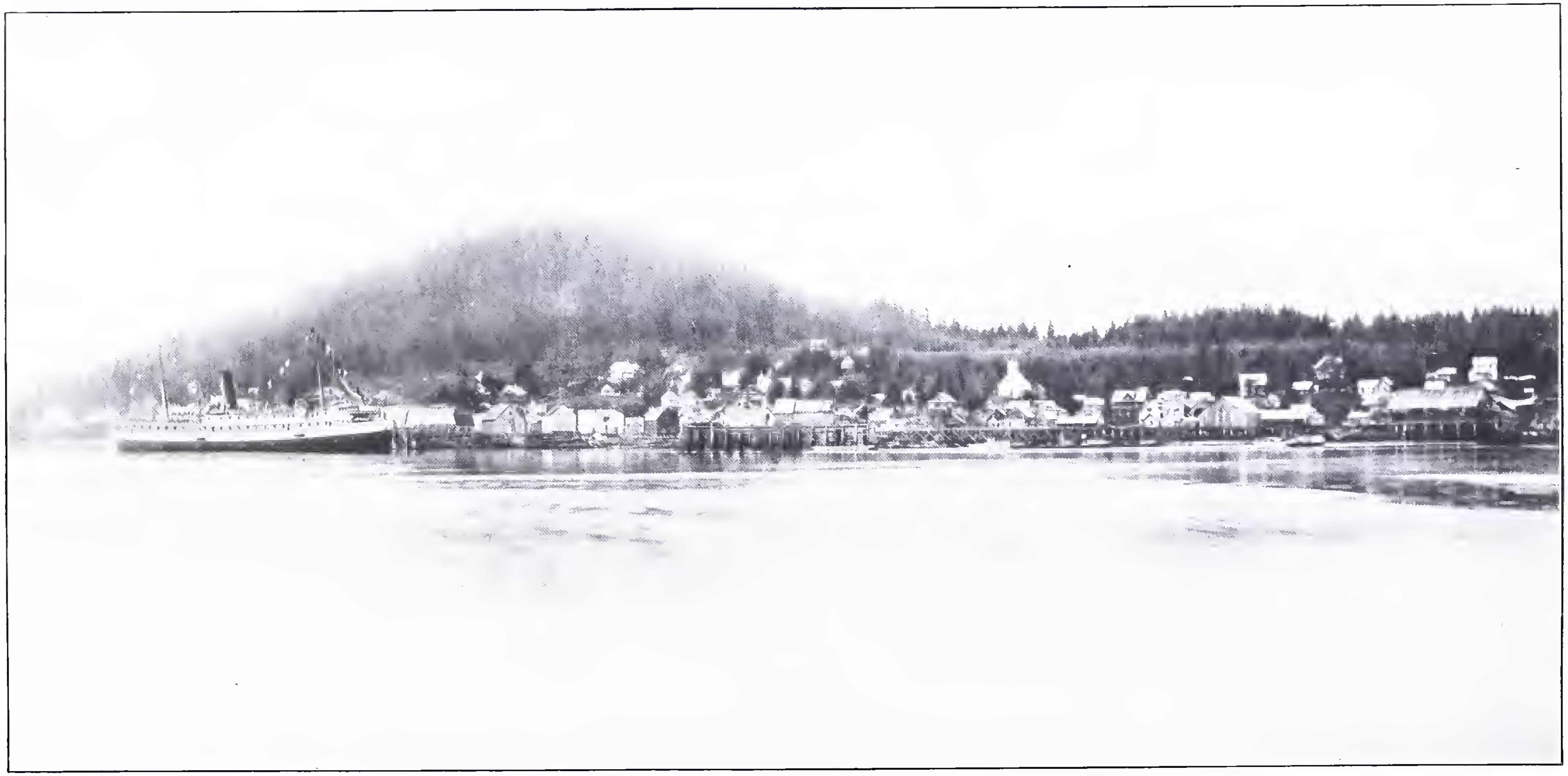
PLATE II.



KETCHIKAN HARBOR.

The rapid growth of this port will soon make necessary the enlargement of its shipping facilities

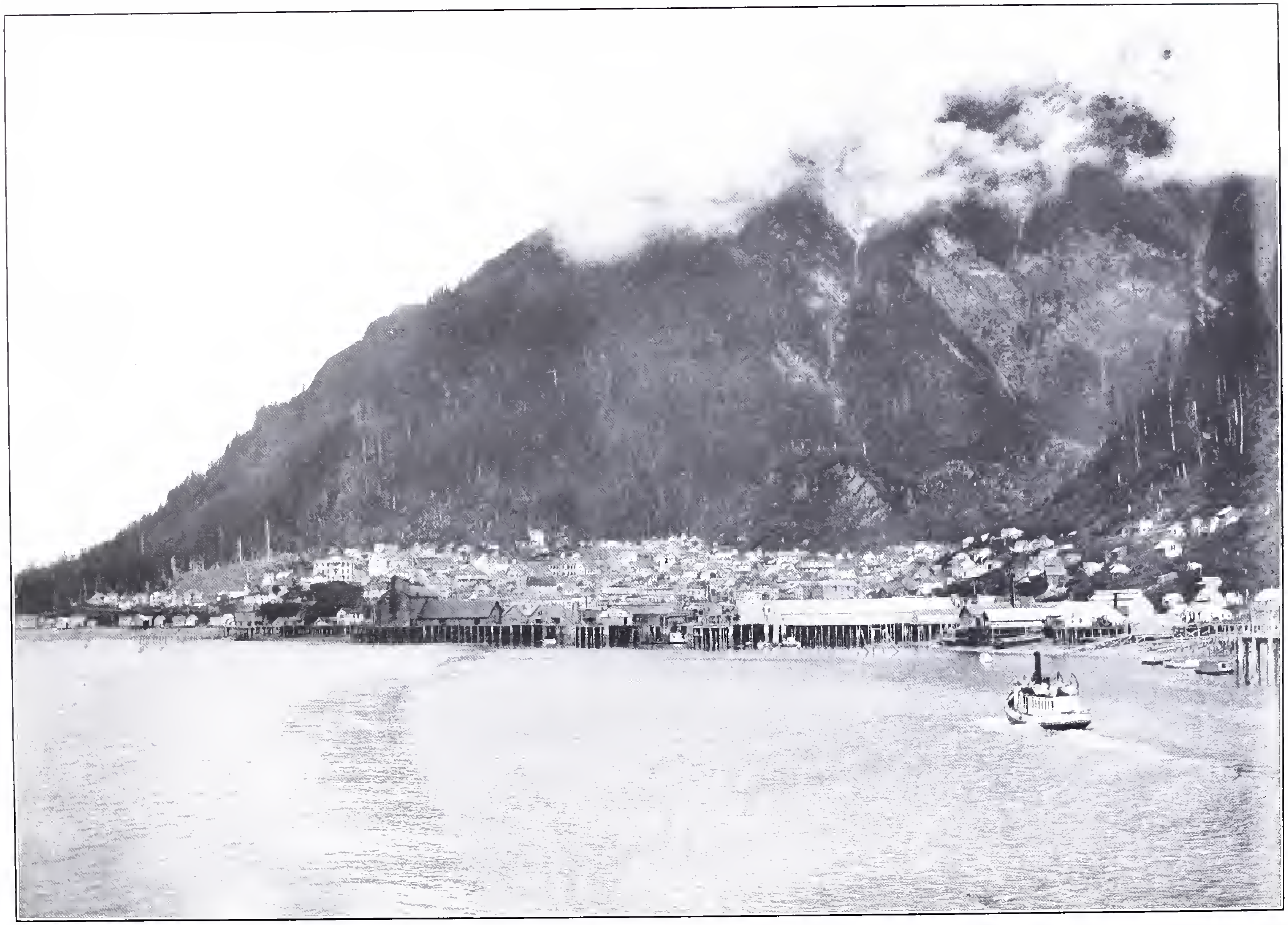
PLATE III.



WRANGELL, WHICH WILL BECOME OF GREATER IMPORTANCE IF THE RECENT FINDS ON THE STIKINE RIVER PROVE AS EXTENSIVE AS THEY PROMISE.

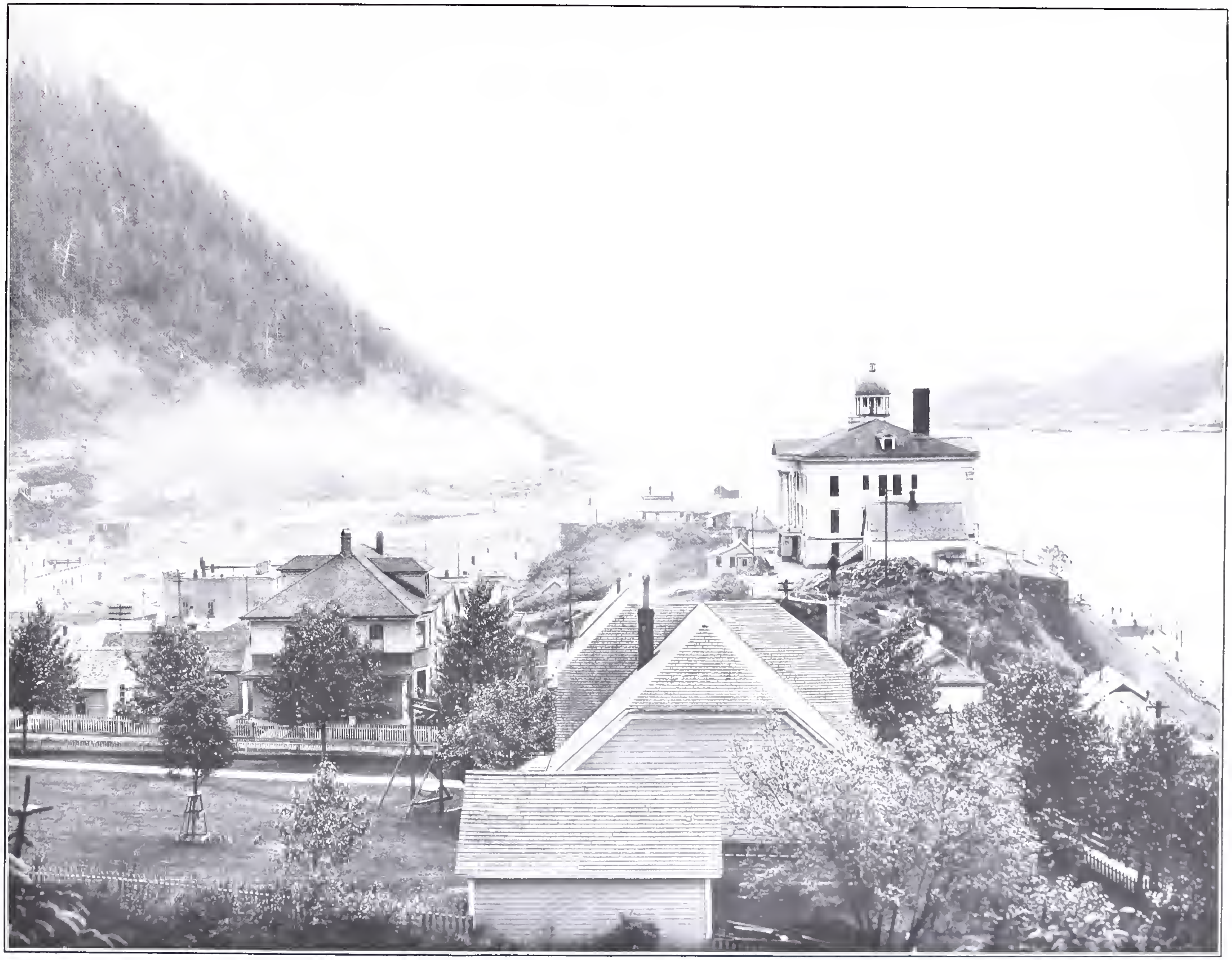
PORTION OF SITKA HARBOR.

This old Russian settlement is one of the tourist attractions of Alaska.



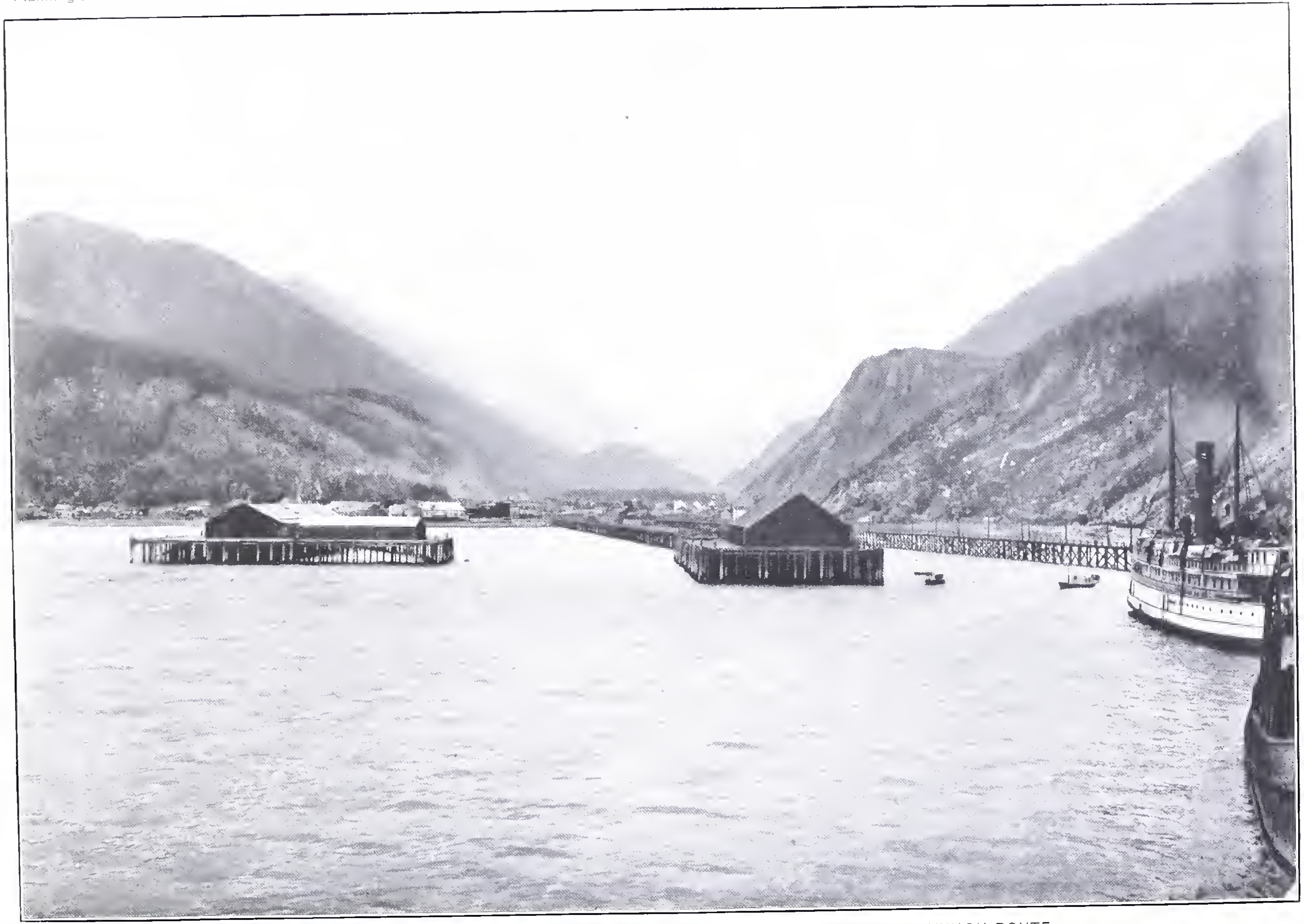
SECTION OF WATER FRONT AT JUNEAU.

Showing present system of hit-or-miss improvements. Extensive improvements will be required during the next few years.

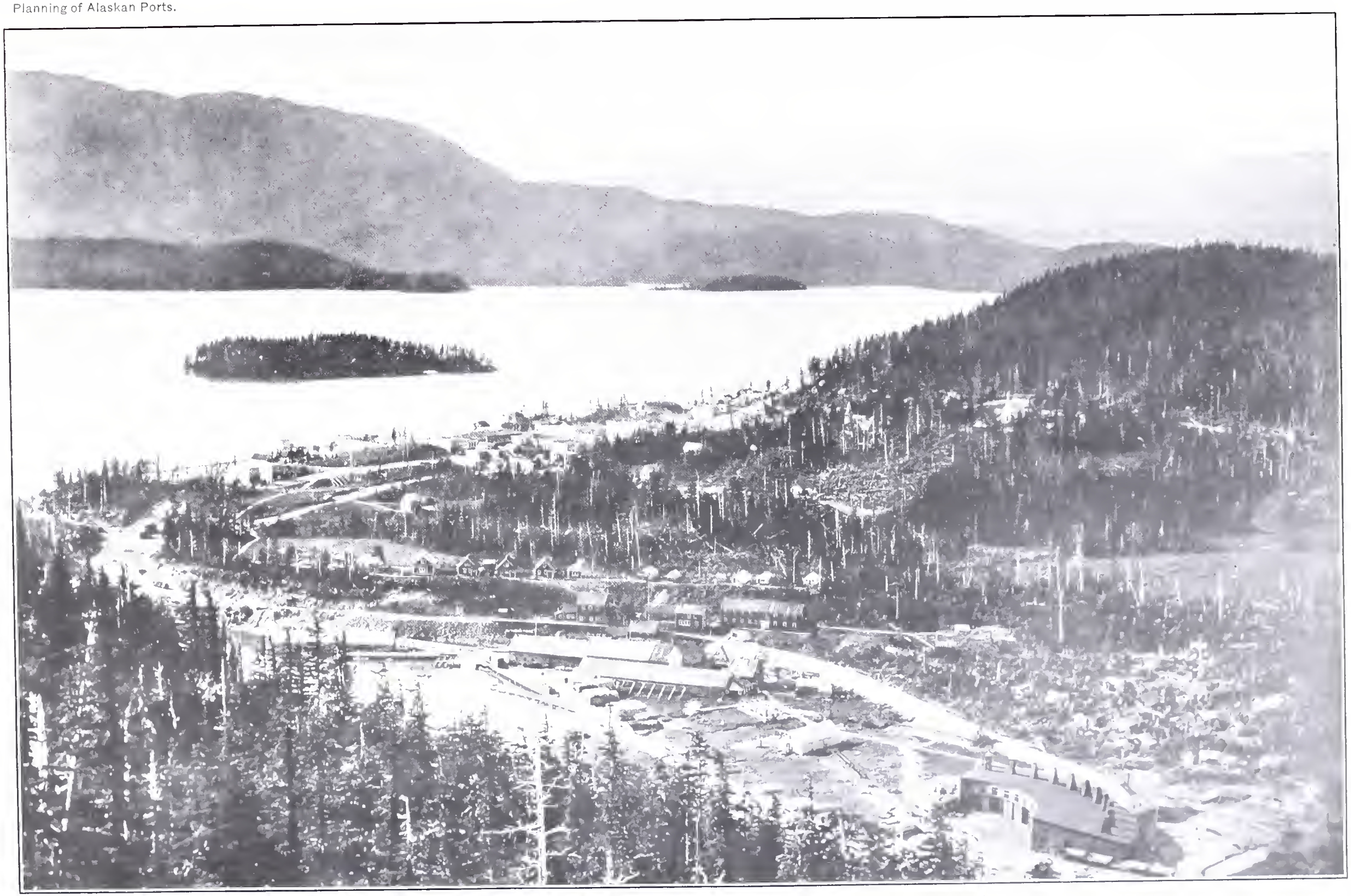


JUNEAU HARBOR.

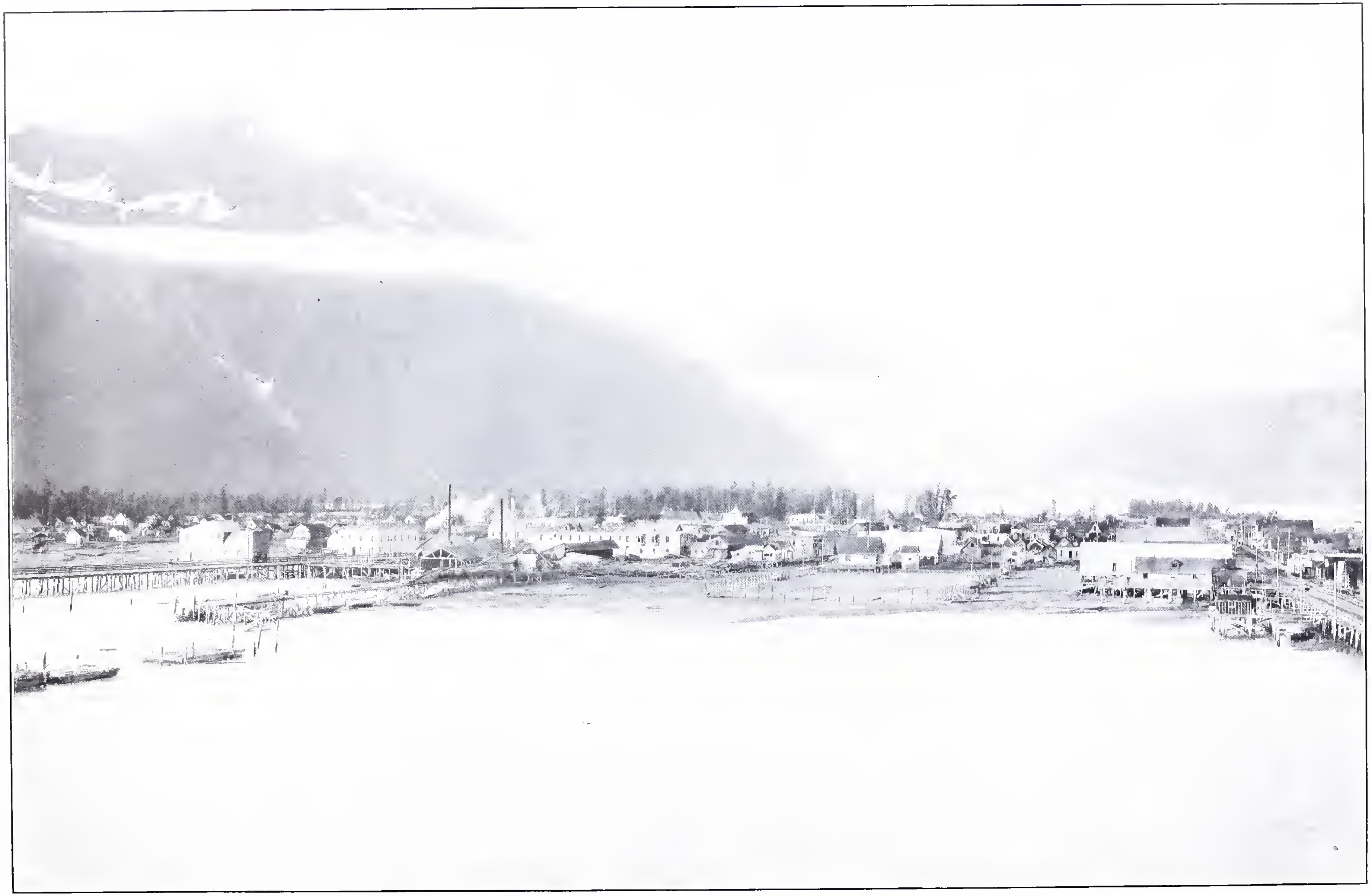
Government building in the foreground.



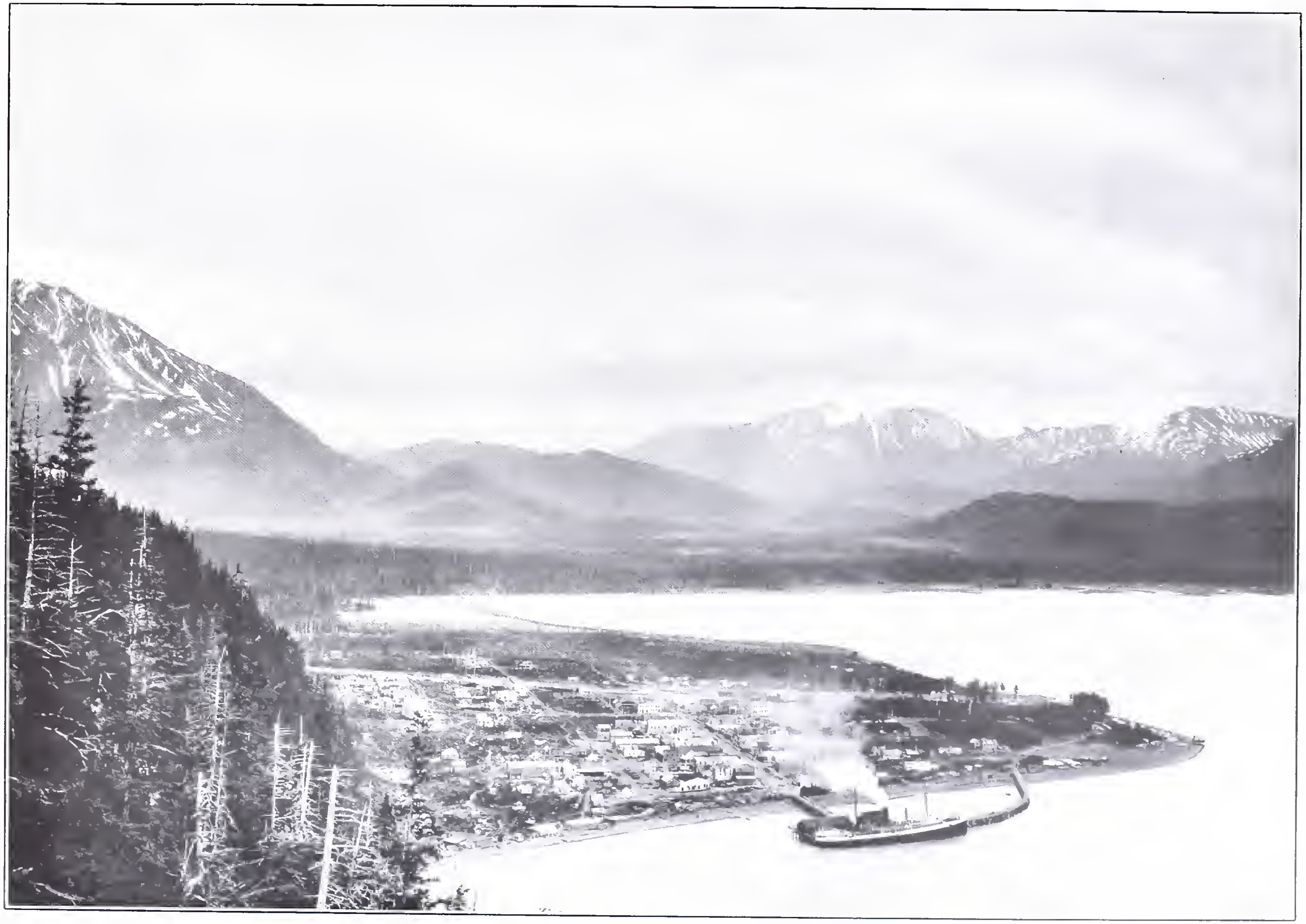
PORTION OF HARBOR AT SKAGWAY, THE TERMINUS OF THE WHITE PASS AND YUKON ROUTE.



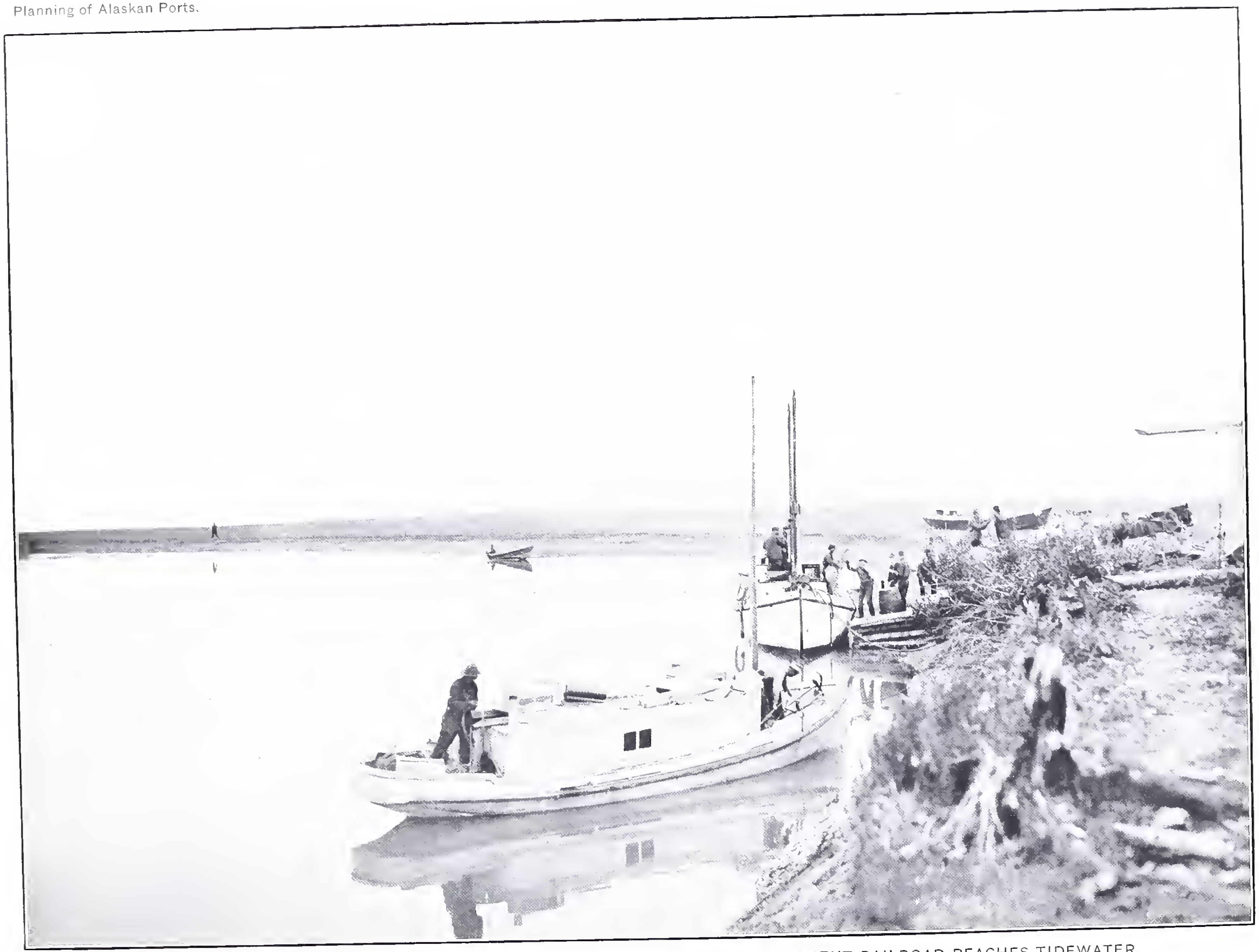
CORDOVA HARBOR, TERMINUS OF THE COPPER RIVER AND NORTHWESTERN RAILWAY.



SECTION OF WATER FRONT AT VALDEZ, AN IMPORTANT PORT ON PRINCE WILLIAM SOUND.



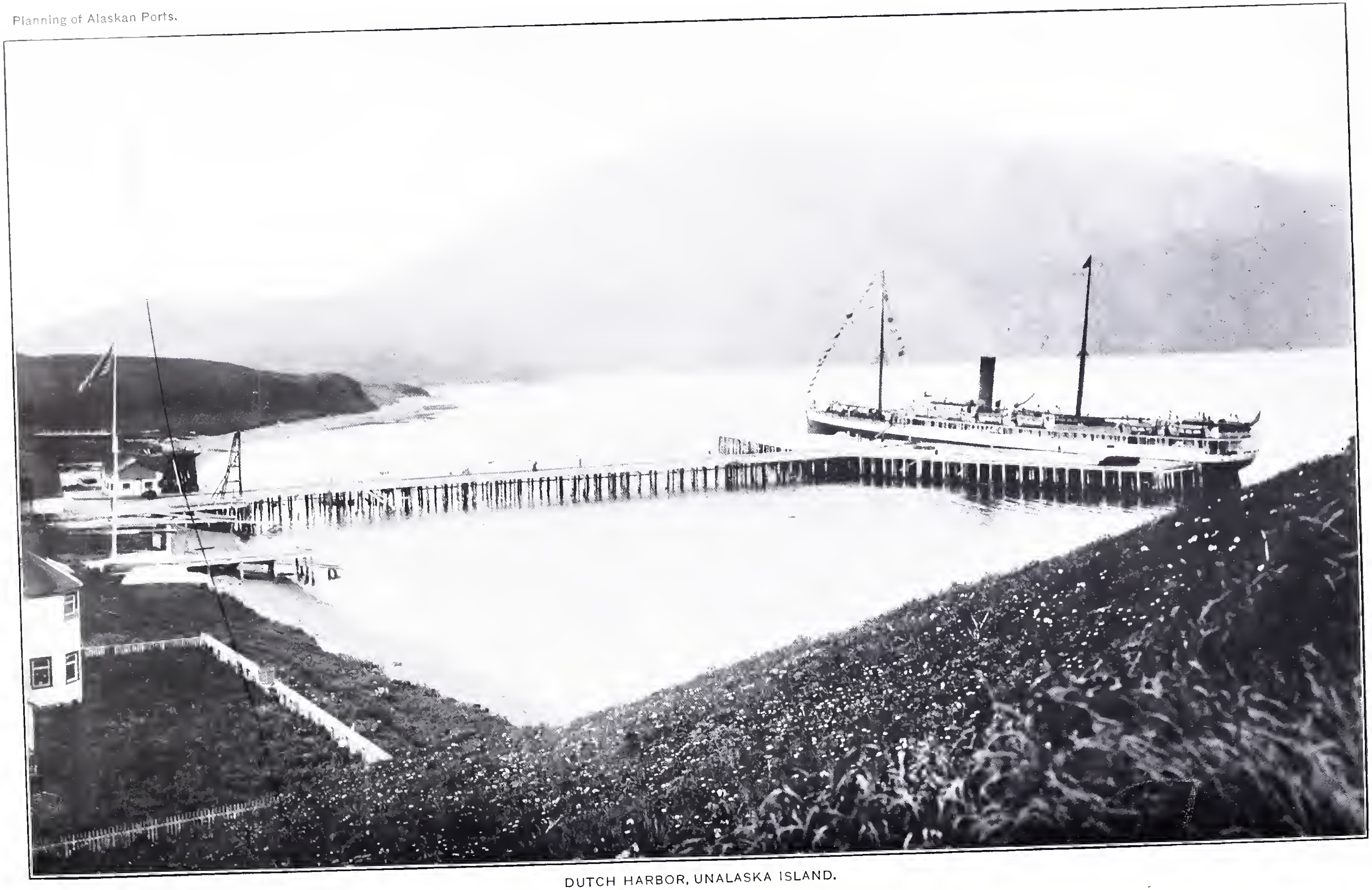
SEWARD, TERMINUS OF THE NEW GOVERNMENT RAILROAD.



SHORE LINE AT ANCHORAGE, ONE OF THE POINTS WHERE THE NEW GOVERNMENT RAILROAD REACHES TIDEWATER.

ROADSTEAD AT ANCHORAGE, ONE OF THE POINTS WHERE THE NEW GOVERNMENT RAILROAD REACHES TIDEWATER.

PLATE XIII.



DUTCH HARBOR, UNALASKA ISLAND.